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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
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Teruaki SOGAWA et al.	)	Confirmation No.: 7139
	)	
Application No.: 10/759,088	)	Group Art Unit: 2627
	)	
Filed: January 20, 2004	)	Examiner: Tawfik A. Goma
	)	
For: OPTICAL PICKUP	)	

Commissioner for Patents
U.S. Patent and Trademark Office
Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir:

SUBMISSION OF VERIFIED TRANSLATION

Applicants submit herewith a Verified Translation of Japanese Patent Application No. 2003-15130, filed in Japan on January 23, 2003. A certified copy of the priority document was filed in the above-identified application on January 20, 2004.

Applicants do not believe that any fees are required with this submission and respectfully request that this Translation be made of record in this application.

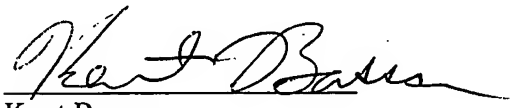
EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this

application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account 50-0310.

Respectfully submitted,

MORGAN, LEWIS & BOCKIUS LLP

Dated: March 14, 2007

By: 
Kent Basson
Registration No. 48,125

CUSTOMER NO. 009629
MORGAN, LEWIS & BOCKIUS LLP
1111 Pennsylvania Avenue, N.W.
Washington, D.C. 20004
202.739.3000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Teruaki Sogawa, et al.

Serial No. : 10/759,088 **Group Art Unit:** 2627

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For: OPTICAL PICKUP

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT UNDER 37 C.F.R. 1.55(a)

Sir,

I, Mitsuhiro Tsuchiya, hereby declare that I am conversant with both English and Japanese languages, and certify to best of my knowledge and belief that the attached is a true and correct English translation of Japanese Patent Application No. 2003-15130 filed on January 23, 2003.

Mitsuhiro Tsuchiya

Date: March 7, 2007

PATENT OFFICE
JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application : January 23, 2003

Application Number : Japanese Patent Application No. 2003-015130

Applicant : FUNAI ELECTRIC CO.,LTD.

[Document Name] Patent Application

[Reference Number] P04686

[Addressee] Commissioner,Patent Office Esq

[International Patent Classification] G11B 7/20

[Title of the Invention] Optical Pickup

[Number of Claims] 7

[Inventor]

[Address] c/o FUNAI ELECTRIC CO.,LTD.,
7-1,Nakagaito7-chome,
Daito-shi,Osaka,Japan

[Name] Teruaki Sogawa

[Inventor]

[Address] c/o FUNAI ELECTRIC CO.,LTD.,
7-1,Nakagaito7-chome,
Daito-shi,Osaka,Japan

[Name] Fumiaki Mori

[Inventor]

[Address] c/o FUNAI ELECTRIC CO.,LTD.,
7-1,Nakagaito7-chome,
Daito-shi,Osaka,Japan

[Name] Noritaka Tanabe

[Applicant for Patent]

[Identification number] 000201113

[Name or title] FUNAI ELECTRIC CO.,LTD

[Representative] Tetsuro Funai

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[Title of the Invention] Optical Pickup

[Claims]

[Claim 1]

An optical pickup in which a photodiode is disposed at one end opening of a light passage hole with a half mirror provided penetratingly in a synthetic resin-made base, a collimator lens and an objective lens are disposed in another end opening thereof, a laser diode is disposed in a laser hole communicating with the light passage hole, laser light is projected from the laser diode onto a disk through the half mirror, the collimator lens, and the objective lens, and reflected light thereof is received by the photodiode through the half mirror, so as to read information recorded on the disk, the optical pickup characterized by comprising:

a metallic holder which is retained on a laser mounting surface formed at a periphery of an opening of the laser hole of the base; and a metallic radiating plate which is attached to an outer peripheral surface of the holder,

wherein the laser diode is fitted in a retaining hole provided penetratingly in the holder concentrically with the laser hole, and an engaging hole which is provided penetratingly in a substantially central portion of the radiating plate and whose diameter is slightly smaller than that of the retaining hole is positioned concentrically with the laser diode, thereby clamping the laser diode by the radiating plate and the holder,

wherein as a pair of slits are formed in the radiating plate, a pair of tongues are cut out in the manner of point symmetry about an axis of the engaging hole, screw inserting recessed portions formed in the respective

tongues are made to communicate with the slits, and as screws are passed through the screw inserting recessed portions of the tongues and through holes in the holder, and are screwed into threaded holes formed in the laser mounting surface, the radiating plate and the holder are secured to the base,

wherein a setting is provided such that as the screws are screwed in, the axis of the engaging hole is positioned on a phantom line connecting points of effort generated at proximal end portions of the tongues, and distances from the axis to the respective points of effort are set to be substantially identical, and

wherein as a recessed portion is formed on the laser mounting surface excluding peripheral edge portions of the threaded holes, a gap is formed between the holder and the base through that recessed portion, and a multiplicity of radiating fins are projectingly provided on the holder.

[Claim 2]

An optical pickup in which a laser diode is disposed in a laser hole communicating with a light passage hole provided penetratingly in a synthetic resin-made base, laser light is projected from the laser diode onto a disk, and reflected light thereof is received by a photodiode so as to read information recorded on the disk, the optical pickup characterized by comprising:

a radiating plate which is made to abut against a rear surface of the laser diode as an engaging hole provided penetratingly in a substantially central portion of the radiating plate is positioned concentrically with the laser diode,

wherein as a pair of slits are formed in the radiating plate, a pair of tongues are cut out in the manner of point symmetry about an axis of the

engaging hole, screw inserting recessed portions formed in the respective tongues are made to communicate with the slits, and as screws are passed through the screw inserting recessed portions of the tongues and are screwed into threaded holes formed in the base, the radiating plate is secured to the base, and

wherein a setting is provided such that as the screws are screwed in, the axis of the engaging hole is positioned on a phantom line connecting points of effort generated at proximal end portions of the tongues, and distances from the axis to the respective points of effort are set to be substantially identical.

[Claim 3]

The optical pickup according to claim 2, characterized by further comprising:

a metallic holder which is retained on a laser mounting surface formed at a periphery of an opening of the laser hole of the base,

wherein the laser diode is fitted in a retaining hole provided penetratingly in the holder concentrically with the laser hole.

[Claim 4]

The optical pickup according to claim 3, wherein the laser diode is clamped by the holder and the radiating plate.

[Claim 5]

The optical pickup according to claim 4, wherein as screws are passed through the screw inserting recessed portions of the tongues and through holes in the holder, and are screwed into threaded holes formed in the laser mounting surface, the radiating plate and the holder are secured to the base.

[Claim 6]

The optical pickup according to any one of claims 2 to 5, wherein as a recessed portion is formed on one or both of an inner peripheral surface of the holder and the laser mounting surface excluding peripheral edge portions of the threaded holes, a gap is formed between the holder and the base through that recessed portion.

[Claim 7]

The optical pickup according to any one of claims 2 to 6, wherein a multiplicity of radiating fins are projectingly provided on the holder.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to an optical pickup for use in a disk player such as a DVD player.

[0002]

[Conventional Art]

Conventionally, as techniques of optical pickups, those disclosed in Japanese Patent Publication No. 11-16205A and the like are known. One such example will be explained with reference to Fig. 13. A photodiode PD is disposed at one end opening 2a of a light passage hole 2 with a half mirror HM provided penetratingly in a synthetic resin-made base 1. A collimator lens QWP and an objective lens OL are disposed in its other end opening 2b, and a laser diode LD and a diffraction grating G are disposed in a laser hole 3 communicating with the light passage hole 2. Laser light is projected from the laser diode LD onto a disk D through the half mirror HM, the collimator lens

QWP, and the objective lens OL, and its reflected light is received by the photodiode PD through the half mirror HM to thereby read information recorded on the disk D.

[0003]

A metallic radiating plate 4 is secured to a laser mounting surface 5 formed at a periphery of the opening of the laser hole 3 in the base 1 by a plurality of (in this arrangement, two) screws 22. As an engaging hole 4a provided penetratingly in a substantially central portion of the radiating plate 4 is positioned concentrically with the laser diode LD, thereby causing the radiating plate 4 to abut against a rear surface of the laser diode LD. This arrangement is designed to prevent a decline in the capacity of the laser diode LD when it generates heat due to the projection of the laser light.

[0004]

[Problems to be Solved by the Invention]

In the above-described construction, through holes 4b for insertion of the screws 22 are merely provided penetratingly in the radiating plate 4, as shown in Figs. 14A and 14B. Consequently, the screws 22 are passed through these through holes 4b and are screwed in threaded holes 23 of the laser mounting surface 5, and heads 22a of the screws 22 are brought into pressure contact with the radiating plate 4. Therefore, the radiating plate 4 is liable to be strained and deformed, so that there are cases where the deformed radiating plate 4 becomes spaced apart from the laser diode LD, thereby making it impossible to sufficiently exhibit a radiating effect (see the phantom lines in Fig. 14).

[0005]

Accordingly, as shown in Fig. 15A, it is conceivable to form a pair of slits 4c in the radiating plate 4 and to thereby cut out a pair of tongues 4A and 4B in the manner of point symmetry about an axis O1 of the engaging hole 4a. Then, it is conceivable to pass the screws 22 through the through holes 4b in the respective tongues 4A and 4B and screw them in the threaded holes 23, thereby causing the radiating plate 4 to abut against a rear surface of the laser diode LD in such a way that the radiating plate 4 will not be deformed.

[0006]

According to the above-described construction, as the screws 22 are screwed in and the heads 22a of the screws 22 are brought into pressure contact with the tongues 4A and 4B with a predetermined pressing force P, the axis O1 of the engaging hole 4a is positionally offset from a phantom line K connecting points of effort O2 and O3 generated at proximal end portions of the tongues 4A and 4B. Therefore, as shown in Fig. 15B, a pressing force P acting from each of the points of effort O2 and O3 toward the axis O1 is divided into a component of force P1 or P2 acting in the direction of the phantom line K and a component of force P3 or P4 acting in a direction perpendicular to the phantom line K. The components of force P1 and P2 are offset by each other, and the bending moment T generated about the axis O1 due to the components of force P3 and P4 is applied to the laser diode LD through the radiating plate 4. As a result, the laser diode LD becomes displaced, and the laser light projected from that laser diode LD becomes positionally offset, thereby possibly making it difficult to accurately read the information recorded on the disk D.

[0007]

In view of the above-described problem, it is an object of the invention to provide an optical pickup which makes it possible to accurately project the laser light by preventing the displacement of the laser diode.

[0008]

[How to Solve the Problems]

To attain the above object, in accordance with the invention according to claim 1, there is provided an optical pickup in which a photodiode is disposed at one end opening of a light passage hole with a half mirror provided penetratingly in a synthetic resin-made base, a collimator lens and an objective lens are disposed in another end opening thereof, a laser diode is disposed in a laser hole communicating with the light passage hole, laser light is projected from the laser diode onto a disk through the half mirror, the collimator lens, and the objective lens, and reflected light thereof is received by the photodiode through the half mirror, so as to read information recorded on the disk, the optical pickup characterized by comprising:

a metallic holder which is retained on a laser mounting surface formed at a periphery of an opening of the laser hole of the base; and a metallic radiating plate which is attached to an outer peripheral surface of the holder,

wherein the laser diode is fitted in a retaining hole provided penetratingly in the holder concentrically with the laser hole, and an engaging hole which is provided penetratingly in a substantially central portion of the radiating plate and whose diameter is slightly smaller than that of the retaining hole is positioned concentrically with the laser diode, thereby clamping the laser diode by the radiating plate and the holder,

wherein as a pair of slits are formed in the radiating plate, a pair of

tongues are cut out in the manner of point symmetry about an axis of the engaging hole, screw inserting recessed portions formed in the respective tongues are made to communicate with the slits, and as screws are passed through the screw inserting recessed portions of the tongues and through holes in the holder, and are screwed into threaded holes formed in the laser mounting surface, the radiating plate and the holder are secured to the base,

wherein a setting is provided such that as the screws are screwed in, the axis of the engaging hole is positioned on a phantom line connecting points of effort generated at proximal end portions of the tongues, and distances from the axis to the respective points of effort are set to be substantially identical, and

wherein as a recessed portion is formed on the laser mounting surface excluding peripheral edge portions of the threaded holes, a gap is formed between the holder and the base through that recessed portion, and a multiplicity of radiating fins are projectingly provided on the holder.

[0009]

According to the above-described construction, as screws are passed through the screw inserting recessed portions of the tongues and the through holes in the holder, and are screwed into the threaded holes of the base, the radiating plate is secured to the base. In addition, since the tongues are merely connected partially to the radiating plate, the radiating plate can be caused to abut against the rear surface of the laser diode in such a way that the radiating plate will not be deformed.

[0010]

In addition, since peripheral edge portions of the screw inserting

recessed portions of the tongues are formed substantially in C-shapes which are resiliently deformable, as heads of the screws are brought into pressure contact with the tongues with a predetermined pressing force, the points of effort can be reliably generated at the proximal end portions of the tongues.

[0011]

A setting is provided such that the axis of the engaging hole formed in a substantially central portion of the radiating plate is positioned on a phantom line connecting the two points of effort. At the same time, distances from the axis to the respective points of effort are set to be substantially identical. Therefore, the pressing forces acting from the respective points of effort toward the axis are offset by each other, and components of force are not generated from both pressing forces. Accordingly, the bending moment with the axis of the engaging hole as a center is not generated in the conventional manner, and the laser diode is not displaced via the radiating plate by that bending moment. Hence, the laser light can be precisely projected from the laser diode without being positionally offset, so that it is possible to accurately read the information recorded on the disk.

[0012]

Further, since the laser diode is mounted on the base through the holder, in a case where the laser diode is determined to be defective in inspection prior to shipment, it is only sufficient to discard that laser diode. Accordingly, it is possible to reuse a diffraction grating and the base separated from the defective laser diode, so that the discarding cost can be low. In addition, since the base is isolated from the heat generation of the laser diode by means of the holder, it is possible to prevent the base from being thermally

expanded and deformed.

[0013]

Furthermore, since the laser diode is clamped by the holder and the radiating plate, the laser diode can be reliably retained in the retaining hole of the holder. Since retaining means such as screws for the retention is not required, the fabrication cost can be lowered by that unrequired portion.

[0014]

Furthermore, the arrangement provided is such that the radiating plate and the holder are integrally secured to the base by means of the screws. Hence, as compared with the case where the radiating plate and the holder are separately secured, the securing operation can be performed speedily and easily with a fewer number of screws.

[0015]

Still further, since areas of contact between the laser diode, on the one hand, and the holder and the radiating plate, on the other hand, are large, and the multiplicity of radiating fins are projectingly provided on the holder, the radiation of the laser diode is accelerated, and the laser diode can be operated efficiently. In addition, since the base is isolated from the heat generation of the laser diode by means of the holder, and the holder and the base are merely in partial contact with each other, there is no possibility of the synthetic resin-made base being thermally expanded and deformed by the heat generation of the laser diode. Hence, it is possible to prevent the occurrence of a read error by maintaining the optical axis connecting the photodiode and the objective lens rectilinearly, as required. It is thereby possible to fabricate an inexpensive and precision optical pickup.

[0016]

In accordance with the invention according to claim 2, there is provided an optical pickup in which a laser diode is disposed in a laser hole communicating with a light passage hole provided penetratingly in a synthetic resin-made base, laser light is projected from the laser diode onto a disk, and reflected light thereof is received by a photodiode so as to read information recorded on the disk, the optical pickup characterized by comprising:

a radiating plate which is made to abut against a rear surface of the laser diode as an engaging hole provided penetratingly in a substantially central portion of the radiating plate is positioned concentrically with the laser diode,

wherein as a pair of slits are formed in the radiating plate, a pair of tongues are cut out in the manner of point symmetry about an axis of the engaging hole, screw inserting recessed portions formed in the respective tongues are made to communicate with the slits, and as screws are passed through the screw inserting recessed portions of the tongues and are screwed into threaded holes formed in the base, the radiating plate is secured to the base, and

wherein a setting is provided such that as the screws are screwed in, the axis of the engaging hole is positioned on a phantom line connecting points of effort generated at proximal end portions of the tongues, and distances from the axis to the respective points of effort are set to be substantially identical.

[0017]

According to the above-described construction, as screws are passed through the screw inserting recessed portions of the tongues and are screwed

into the threaded holes of the base, the radiating plate is secured to the base. In addition, since the tongues are merely connected partially to the radiating plate, the radiating plate can be caused to abut against the rear surface of the laser diode in such a way that the radiating plate will not be deformed.

[0018]

In addition, since peripheral edge portions of the screw inserting recessed portions of the tongues are formed substantially in C-shapes which are resiliently deformable, as heads of the screws are brought into pressure contact with the tongues with a predetermined pressing force, the points of effort can be reliably generated at the proximal end portions of the tongues.

[0019]

Further, a setting is provided such that the axis of the engaging hole formed in a substantially central portion of the radiating plate is positioned on a phantom line connecting the two points of effort. At the same time, distances from the axis to the respective points of effort are set to be substantially identical. Therefore, the pressing forces acting from the respective points of effort toward the axis are offset by each other, and components of force are not generated from both pressing forces. Accordingly, the bending moment with the axis as a center is not generated in the conventional manner, and the laser diode is not displaced via the radiating plate by that bending moment. Hence, the laser light can be precisely projected from the laser diode without being positionally offset, so that it is possible to accurately read the information recorded on the disk.

[0020]

In the invention according to claim 3, the optical pickup further

comprises: a metallic holder which is retained on a laser mounting surface formed at a periphery of an opening of the laser hole of the base, wherein the laser diode is fitted in a retaining hole provided penetratingly in the holder concentrically with the laser hole.

[0021]

According to the above-described construction, since the laser diode is mounted on the base through the holder, in a case where the laser diode is determined to be defective in inspection prior to shipment, it is only sufficient to discard that laser diode. Accordingly, it is possible to reuse a diffraction grating and the base separated from the defective laser diode, so that the discarding cost can be low. In addition, since the base is isolated from the heat generation of the laser diode by means of the holder, it is possible to prevent the base from being thermally expanded and deformed.

[0022]

In accordance with the invention according to claim 4, in the invention according to claim 3, the laser diode is clamped by the holder and the radiating plate.

[0023]

According to the above-described construction, since the laser diode is clamped by the holder and the radiating plate, the laser diode can be reliably retained in the retaining hole of the holder. Since retaining means such as screws for the retention is not required, the fabrication cost can be lowered by that unrequired portion. In addition, since the areas of contact between the laser diode, on the one hand, and the holder and the radiating plate, on the other hand, are large, the radiating effect is large.

[0024]

In accordance with the invention according to claim 5, in the invention according to claim 4, as screws are passed through the screw inserting recessed portions of the tongues and through holes in the holder, and are screwed into threaded holes formed in the laser mounting surface, the radiating plate and the holder are secured to the base.

[0025]

According to the above-described construction, the arrangement provided is such that the radiating plate and the holder are integrally secured to the base by means of the screws. Hence, as compared with the case where the radiating plate and the holder are separately secured, the securing operation can be performed speedily and easily with a fewer number of screws.

[0026]

In accordance with the invention according to claim 6, in the invention according to any one of claims 2 to 5, as a recessed portion is formed on one or both of an inner peripheral surface of the holder and the laser mounting surface excluding peripheral edge portions of the threaded holes, a gap is formed between the holder and the base through that recessed portion.

[0027]

According to the above-described construction, since the holder and the base are merely in partial contact with each other, the base is not much subjected to the thermal effect due to the heat generation by the laser diode. Hence, it is possible to prevent the base from undergoing thermal deformation.

[0028]

In accordance with the invention according to claim 7, in the invention according to any one of claims 2 to 6, a multiplicity of radiating fins are projectingly provided on the holder.

[0029]

According to the above-described construction, radiation can be further accelerated by the multiplicity of radiating fins provided projectingly on the holder, thereby allowing the laser diode to operate efficiently.

[0030]

[Embodiments of the Invention]

Figs. 1 to 7 show an optical pickup in accordance with an embodiment of the invention. This optical pickup has a metallic holder 6 which is retained on a laser mounting surface 5 formed at a periphery of an opening of a laser hole 3 of a base 1, as well as a metallic radiating plate 7 which is attached to an outer peripheral surface of the holder 6. Since the construction other than the one described above is substantially identical to that shown in Figs. 13 to 15, identical portions will be denoted by the same reference numerals, and a description thereof will be omitted.

[0031]

The base 1 is formed of a hard synthetic resin, and, as shown in Figs. 1 to 7, includes a tubular base body 1a with the laser mounting surface 5 formed thereon, a base plate portion 1b formed integrally with the base body 1a, and a pair of brackets 1c and a rack 1d which are projectingly provided as a unit on the base plate portion 1b. A guide rod 10 is movably fitted in through holes 9 of the brackets 1c, and a pinion (not shown) meshing with the rack 1d is rotated forwardly or reversely, thereby allowing the base 1 to move

forwardly *a* or backwardly *b* along the guide rod 10.

[0032]

As shown in Figs. 3 and 4, the holder 6 has a rectangular holder body 6a of substantially the same size as that of the laser mounting surface 5. A retaining hole 12, which is formed by a large-diameter portion 12a of substantially the same diameter as an outside diameter of a laser diode LD and a small-diameter portion 12b of a slightly smaller diameter than that large-diameter portion 12a, is penetratingly provided in a substantially central portion of the holder body 6a. The laser diode LD is fitted in the retaining hole 12, and two positioning recessed portions 13 provided on an inner peripheral surface of the holder body 6a with the retaining hole 12 positioned therebetween are respectively fitted to two positioning projecting portions 14 provided projectingly on the laser mounting surface 5. As a result, the laser diode LD is positioned concentrically with the laser hole 3 (see Fig. 8).

[0033]

According to the above-described construction, since the laser diode LD is mounted on the base 1 through the holder 6, in a case where the laser diode LD is determined to be defective in inspection prior to shipment, it is only sufficient to discard that laser diode LD. Accordingly, it is possible to reuse a diffraction grating G and the base 1 separated from the defective laser diode LD, so that the discarding cost can be low. In addition, since the base 1 is isolated from the heat generation of the laser diode LD by means of the holder 6, it is possible to prevent the base 1 from being thermally expanded and deformed.

[0034]

As shown in Figs. 1 and 3, the radiating plate 7 consists of a radiating plate body 7a which opposes the holder 6 and is larger than the holder 6, as well as a pair of left and right wing plates 7b and 7c which are respectively bent from both ends of the radiating plate body 7a toward the base 1 side. An engaging hole 16 whose diameter is slightly smaller than that of the retaining hole 12 is formed in a substantially central portion of the radiating plate body 7a. As two positioning holes 17 formed in the radiating plate body 7a with the engaging hole 16 positioned therebetween are respectively fitted to two positioning projecting portions 18 provided projectingly on the holder body 6a, the radiating plate 7 is positioned with respect to the holder 6. At the same time, the engaging hole 16 is made concentric with the retaining hole 12, and the laser diode LD is clamped by the holder 6 and the radiating plate 7 (see Fig. 8).

[0035]

In addition, as a pair of slits 19 are formed in the radiating plate body 7a, a pair of tongues 7A and 7B are cut out in the manner of point symmetry about the axis O1 of the engaging hole 16. Screw insertion recessed portions 20 formed in the respective tongues 7A and 7B are made to communicate with the slits 19. As screws 22 are passed through the screw inserting recessed portions 20 of the tongues 7A and 7B and the through holes 21 in the holder body 6a, and are screwed into threaded holes 23 formed in the laser mounting surface 5, the radiating plate 7 and the holder 6 are secured to the laser mounting surface 5 (see Fig. 9).

[0036]

According to the above-described construction, since the tongues 7A

and 7B are merely connected partially to the radiating plate 7, the radiating plate 7 can be caused to abut against the rear surface of the laser diode LD in such a way that the radiating plate 7 will not be deformed.

[0037]

In addition, since the laser diode LD is clamped by the holder 6 and the radiating plate 7, the laser diode LD can be reliably retained in the retaining hole 12 of the holder 6. Since retaining means such as screws for the retention is not required, the fabrication cost can be lowered by that unrequired portion.

[0038]

Further, the arrangement provided is such that the radiating plate 7 and the holder 6 are integrally secured to the base 1 by means of the screws 22. Hence, as compared with the case where the radiating plate 7 and the holder 6 are separately secured, the securing operation can be performed speedily and easily with a fewer number of screws 22.

[0039]

As shown in Figs. 12A and 12B, a setting is provided such that as the screws 22 are screwed in, the axis O1 of the engaging hole 16 is positioned on a phantom line K connecting the points of effort O2 and O3 generated at proximal end portions of the tongues 7A and 7B. At the same time, distances L1 and L2 from the axis O1 to the respective points of effort O2 and O3 are set to be substantially identical.

[0040]

According to the above-described construction, since peripheral edge portions of the screw inserting recessed portions 20 of the tongues 7A and 7B

are formed substantially in C-shapes which are resiliently deformable, as heads 22a of the screws 22 are brought into pressure contact with the tongues 7A and 7B with a predetermined pressing force P, the points of effort O2 and O3 can be reliably generated at the proximal end portions of the tongues 7A and 7B.

[0041]

In addition, the pressing forces P acting from the respective points of effort O2 and O3 toward the axis O1 are offset by each other, and components of force are not generated from both pressing forces P. Accordingly, the bending moment (see bending moment T in Fig. 15) with the axis O1 of the engaging hole 16 as a center is not generated in the conventional manner, and the laser diode LD is not displaced via the radiating plate 7 by that bending moment. Hence, the laser light can be precisely projected from the laser diode LD without being positionally offset, so that it is possible to accurately read the information recorded on a disk D.

[0042]

As shown in Figs. 1 and 2, a recessed portion 25 is formed on the laser mounting surface 5 excluding peripheral edge portions 5a of the respective threaded holes 23, so that the peripheral portions 5a of the threaded holes 23 are formed to be one step higher. Consequently, a gap □ is formed between the holder 6 and the base 1 through that recessed portion 25, and the holder 6 and the base 1 are merely in partial contact with each other. Therefore, the base 1 is not much subjected to the thermal effect due to the heat generation by the laser diode LD.

[0043]

As shown in Figs. 3 and 4, a multiplicity of radiating fins 26 are projectingly provided on an entire outer peripheral surface and a peripheral edge portion of an inner peripheral surface of the holder body 6a. Radiation can be further accelerated by the multiplicity of radiating fins 26, thereby allowing the laser diode LD to operate efficiently.

[0044]

In short, as described above, since areas of contact between the laser diode LD, on the one hand, and the holder 6 and the radiating plate 7, on the other hand, are large, and the multiplicity of radiating fins 26 are projectingly provided on the holder 6, the radiation of the laser diode LD is accelerated, and the laser diode LD can be operated efficiently. In addition, since the base 1 is isolated from the heat generation of the laser diode LD by means of the holder 6, and the holder 6 and the base 1 are merely in partial contact with each other, there is no possibility of the synthetic resin-made base 1 being thermally expanded and deformed by the heat generation of the laser diode LD. Hence, it is possible to prevent the occurrence of a read error by maintaining an optical axis O (see Fig. 13) connecting a photodiode PD and an objective lens OL rectilinearly, as required. It is thereby possible to fabricate an inexpensive and precision optical pickup.

[0045]

In Fig. 3, reference numeral 28 denotes a presser spring made of a leaf spring which consists of a ring portion 28a and a pair of leg portions 28b provided projectingly on the ring portion 28a and extending outward. As shown in Figs. 10 and 11, the ring portion 28a is inserted in the laser hole 3, and the leg portions 28b are inserted in a pair of groove portions 29

communicating with the laser hole 3. Consequently, the presser spring 28 is interposed between the holder 6 and the diffraction grating G in such a manner as to be resiliently deformed, thereby preventing the diffraction grating G from rotating unexpectedly.

[0046]

As shown in Figs. 6 and 11, an operation hole 30 for a diffraction grating, which communicates with the laser hole 3, is penetratingly provided in the base body 1a. As an operation rod 31 inserted in the operation hole 30 is brought into contact with an outer peripheral surface of the diffraction grating, and the operation rod 31 is operated, the diffraction grating G is rotated to disperse the laser light, as desired.

[0047]

In the above-described construction, the recessed portion 25 is formed on the laser mounting surface 5 to form the gap □ between the holder 6 and the base 1, the invention is not limited to the same. The recessed portion 25 may be formed on an inner peripheral surface of the holder 6, or the recessed portion may be formed on both the inner peripheral surface of the holder 6 and the laser mounting surface 5.

[0048]

[Advantages of the Invention]

In accordance with the invention according to claim 1, as screws are passed through the screw inserting recessed portions of the tongues and the through holes in the holder, and are screwed into the threaded holes of the base, the radiating plate is secured to the base. In addition, since the tongues are merely connected partially to the radiating plate, the radiating

plate can be caused to abut against the rear surface of the laser diode in such a way that the radiating plate will not be deformed.

[0049]

In addition, since peripheral edge portions of the screw inserting recessed portions of the tongues are formed substantially in C-shapes which are resiliently deformable, as heads of the screws are brought into pressure contact with the tongues with a predetermined pressing force, the points of effort can be reliably generated at the proximal end portions of the tongues.

[0050]

A setting is provided such that the axis of the engaging hole formed in a substantially central portion of the radiating plate is positioned on a phantom line connecting the two points of effort. At the same time, distances from the axis to the respective points of effort are set to be substantially identical. Therefore, the pressing forces acting from the respective points of effort toward the axis are offset by each other, and components of force are not generated from both pressing forces. Accordingly, the bending moment with the axis of the engaging hole as a center is not generated in the conventional manner, and the laser diode is not displaced via the radiating plate by that bending moment. Hence, the laser light can be precisely projected from the laser diode without being positionally offset, so that it is possible to accurately read the information recorded on the disk.

[0051]

Further, since the laser diode is mounted on the base through the holder, in a case where the laser diode is determined to be defective in inspection prior to shipment, it is only sufficient to discard that laser diode.

Accordingly, it is possible to reuse a diffraction grating and the base separated from the defective laser diode, so that the discarding cost can be low. In addition, since the base is isolated from the heat generation of the laser diode by means of the holder, it is possible to prevent the base from being thermally expanded and deformed.

[0052]

Furthermore, since the laser diode is clamped by the holder and the radiating plate, the laser diode can be reliably retained in the retaining hole of the holder. Since retaining means such as screws for the retention is not required, the fabrication cost can be lowered by that unrequired portion.

[0053]

Furthermore, the arrangement provided is such that the radiating plate and the holder are integrally secured to the base by means of the screws. Hence, as compared with the case where the radiating plate and the holder are separately secured, the securing operation can be performed speedily and easily with a fewer number of screws.

[0054]

Still further, since areas of contact between the laser diode, on the one hand, and the holder and the radiating plate, on the other hand, are large, and the multiplicity of radiating fins are projectingly provided on the holder, the radiation of the laser diode is accelerated, and the laser diode can be operated efficiently. In addition, since the base is isolated from the heat generation of the laser diode by means of the holder, and the holder and the base are merely in partial contact with each other, there is no possibility of the synthetic resin-made base being thermally expanded and deformed by the heat

generation of the laser diode. Hence, it is possible to prevent the occurrence of a read error by maintaining the optical axis connecting the photodiode and the objective lens rectilinearly, as required. It is thereby possible to fabricate an inexpensive and precision optical pickup.

[0055]

In accordance with the invention according to claim 2, as screws are passed through the screw inserting recessed portions of the tongues and are screwed into the threaded holes of the base, the radiating plate is secured to the base. In addition, since the tongues are merely connected partially to the radiating plate, the radiating plate can be caused to abut against the rear surface of the laser diode in such a way that the radiating plate will not be deformed.

[0056]

In addition, since peripheral edge portions of the screw inserting recessed portions of the tongues are formed substantially in C-shapes which are resiliently deformable, as heads of the screws are brought into pressure contact with the tongues with a predetermined pressing force, the points of effort can be reliably generated at the proximal end portions of the tongues.

[0057]

Further, a setting is provided such that the axis of the engaging hole formed in a substantially central portion of the radiating plate is positioned on a phantom line connecting the two points of effort. At the same time, distances from the axis to the respective points of effort are set to be substantially identical. Therefore, the pressing forces acting from the respective points of effort toward the axis are offset by each other, and components of force are

not generated from both pressing forces. Accordingly, the bending moment with the axis as a center is not generated in the conventional manner, and the laser diode is not displaced via the radiating plate by that bending moment. Hence, the laser light can be precisely projected from the laser diode without being positionally offset, so that it is possible to accurately read the information recorded on the disk.

[0058]

In accordance with the invention according to claim 3, since the laser diode is mounted on the base through the holder, in a case where the laser diode is determined to be defective in inspection prior to shipment, it is only sufficient to discard that laser diode. Accordingly, it is possible to reuse a diffraction grating and the base separated from the defective laser diode, so that the discarding cost can be low. In addition, since the base is isolated from the heat generation of the laser diode by means of the holder, it is possible to prevent the base from being thermally expanded and deformed.

[0059]

According to the above-described construction, since the laser diode is clamped by the holder and the radiating plate, the laser diode can be reliably retained in the retaining hole of the holder. Since retaining means such as screws for the retention is not required, the fabrication cost can be lowered by that unrequired portion. In addition, since the areas of contact between the laser diode, on the one hand, and the holder and the radiating plate, on the other hand, are large, the radiating effect is large.

[0060]

In accordance with the invention according to claim 5, the

arrangement provided is such that the radiating plate and the holder are integrally secured to the base by means of the screws. Hence, as compared with the case where the radiating plate and the holder are separately secured, the securing operation can be performed speedily and easily with a fewer number of screws.

[0061]

In accordance with the invention according to claim 6, since the holder and the base are merely in partial contact with each other, the base is not much subjected to the thermal effect due to the heat generation by the laser diode. Hence, it is possible to prevent the base from undergoing thermal deformation.

[0062]

In accordance with the invention according to claim 7, radiation can be further accelerated by the multiplicity of radiating fins provided projectingly on the holder, thereby allowing the laser diode to operate efficiently.

[Brief Description of the Drawings]

Fig. 1 is a perspective view of an optical pickup in accordance with an embodiment of the invention;

Fig. 2 is a perspective view of a base thereof;

Fig. 3 is an exploded perspective view of a radiation structure thereof;

Fig. 4 is a perspective view of an inner peripheral surface side of a holder thereof;

Fig. 5 is a front elevational view of the optical pickup;

Fig. 6 is a side elevational view of the optical pickup;

Fig. 7 is a plan view of the optical pickup;

Fig. 8 is a view taken in the direction of arrows along line A-A in Fig.5;

Fig. 9 is a view taken in the direction of arrows along line B-B in Fig.5;

Fig. 10 is a view taken in the direction of arrows along line C-C in Fig.5;

Fig. 11 is a view taken in the direction of arrows along line D-D in Fig.5;

Fig. 12A is an explanatory diagram illustrating a pressing force applied to a radiating plate;

Fig. 12B is a diagram of a basic principle thereof;

Fig. 13 is a diagram illustrating a conventional example;

Fig. 14A is a front elevational view of the radiating plate;

Fig. 14B is a view taken in the direction of arrows along line E-E in Fig. 14A;

Fig. 15A is an explanatory diagram illustrating the pressing force in a modification of the radiating plate; and

Fig. 15B is a diagram of the basic principle thereof.

[Description of the Reference Numerals and Signs]

1: base

2: light passage hole

3: laser hole

5: laser mounting surface

6: holder

7: radiating plate

7A, 7B: tongues

16: engaging hole

19: slit

20: screw inserting recessed portion

22: screw

22a: head of the screw

23: threaded hole

25: recessed portion

26: radiating fin

HM: half mirror

PD: photodiode

QWP: collimator lens

OL: objective lens

LD: laser diode

D: disk

α: gap

O1: axis of an engaging hole

O2, O3: points of effort

K: phantom line connecting the points of effort

P: pressing force

[Designation of Document] Abstract

[Abstract]

[Object]

To project laser light precisely.

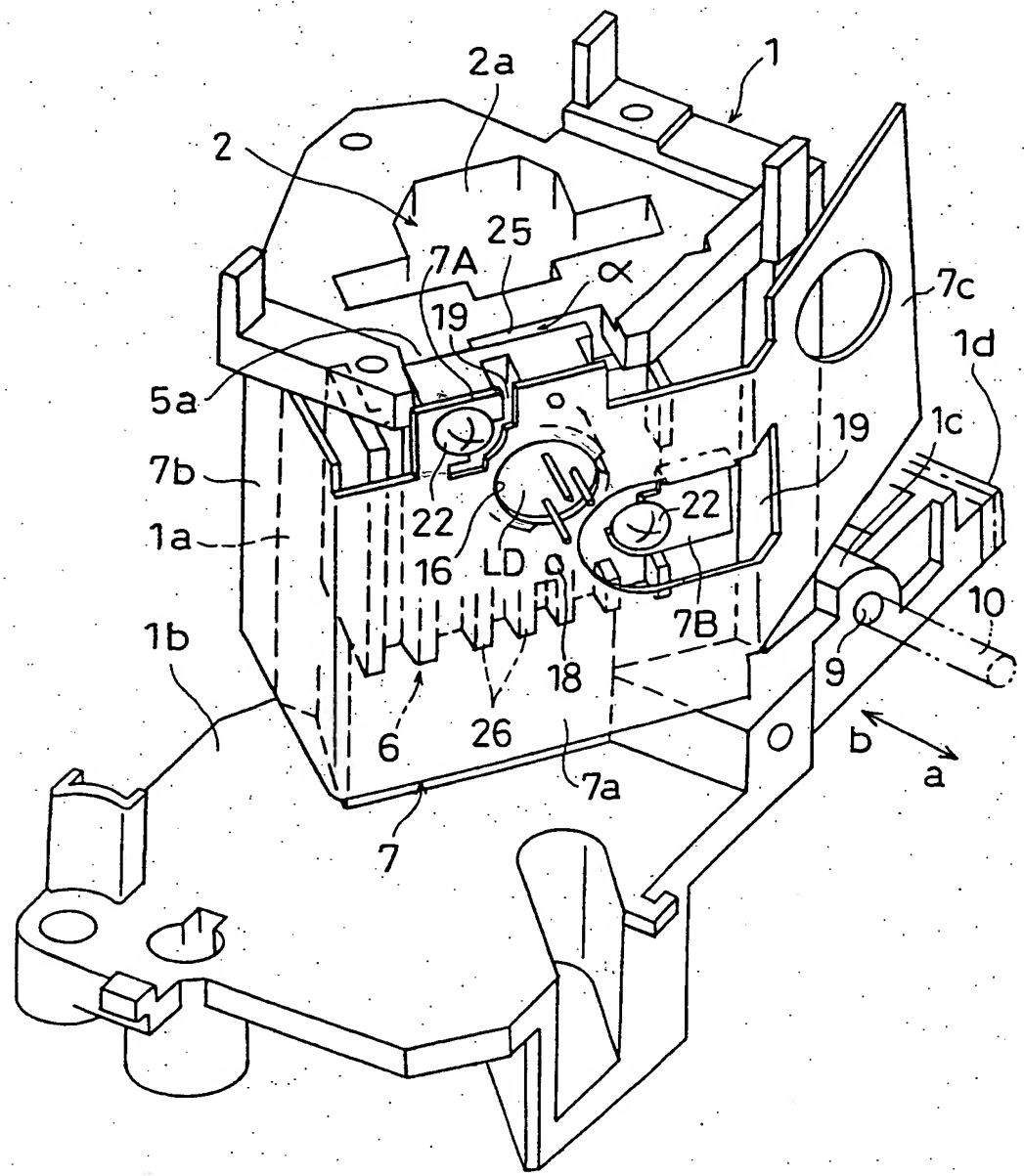
[How to Achieve the Object]

A radiating plate 7 is provided which is made to abut against a rear surface of a laser diode LD by positioning an engaging hole 16 provided penetratingly in a central portion of the radiating plate 7 concentrically with the laser diode LD. As a pair of slits 19 are formed in the radiating plate 7, a pair of tongues 7A and 7B are cut out in the manner of point symmetry about an axis O1 of the engaging hole 16. Screw insertion recessed portions 20 formed in the respective tongues 7A and 7B are made to communicate with the slits 19. As screws 22 are passed through the screw inserting recessed portions 20 of the tongues 7A and 7B and are screwed in, the radiating plate 7 is secured to the base 1. A setting is provided such that as the screws 22 are screwed in, the axis O1 is positioned on a phantom line K connecting points of effort O2 and O3 generated at proximal end portions of the tongues 7A and 7B. At the same time, distances L1 and L2 from the axis O1 to the respective points of effort O2 and O3 are set to be substantially identical.

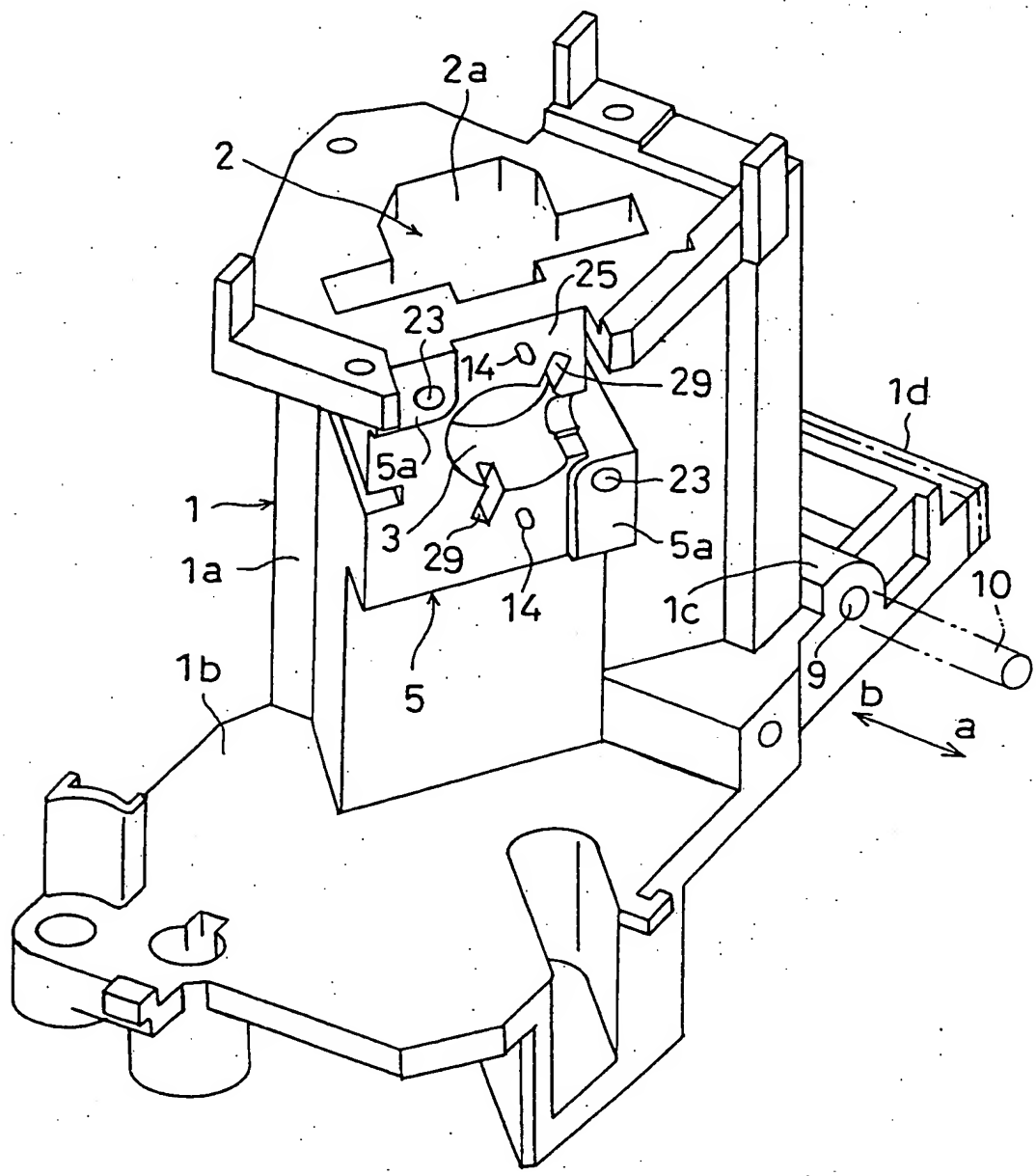
[Representative Drawing] Fig. 5

【書類名】　図面
Designation of Document　Drawings

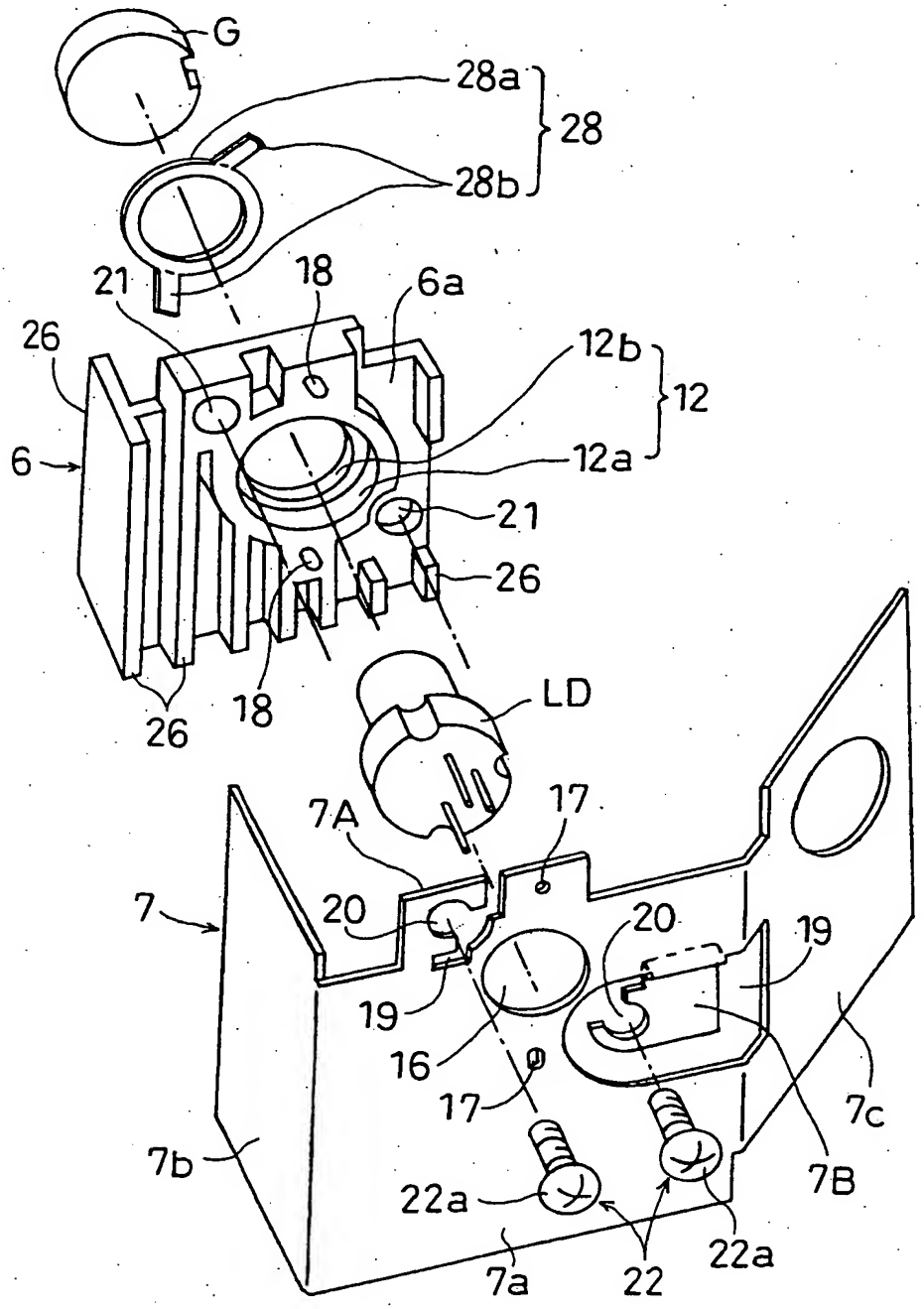
【図１】
Fig. 1



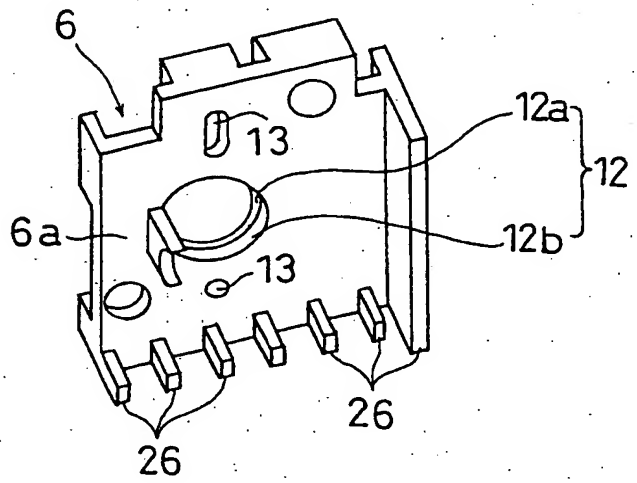
【図２】　Fig. 2



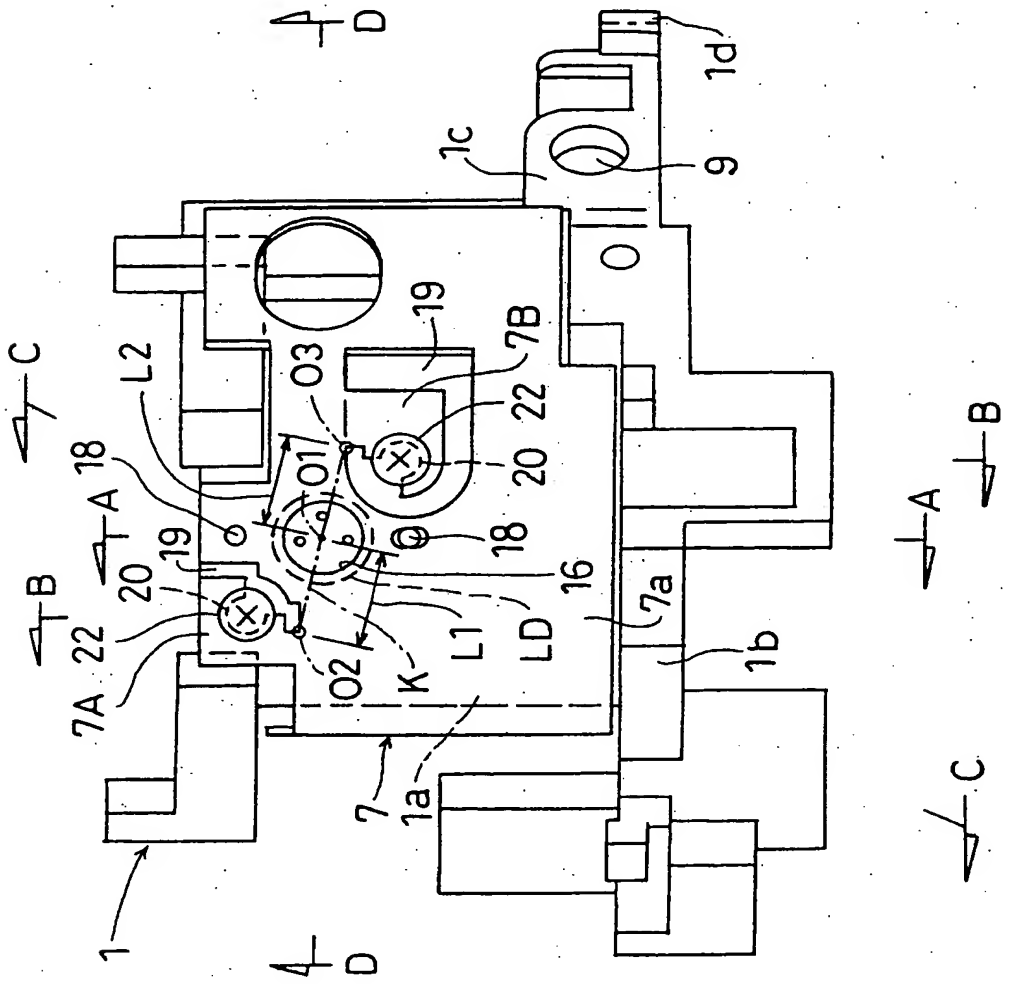
【図３】　Fig.3


G
28a
28
28b
21
18
6a
26
12b
12
6
12a
21
26
18
26
LD
7A
17
7
20
20
19
19
16
17
7c
7b
7B
22a
22a
7a
22

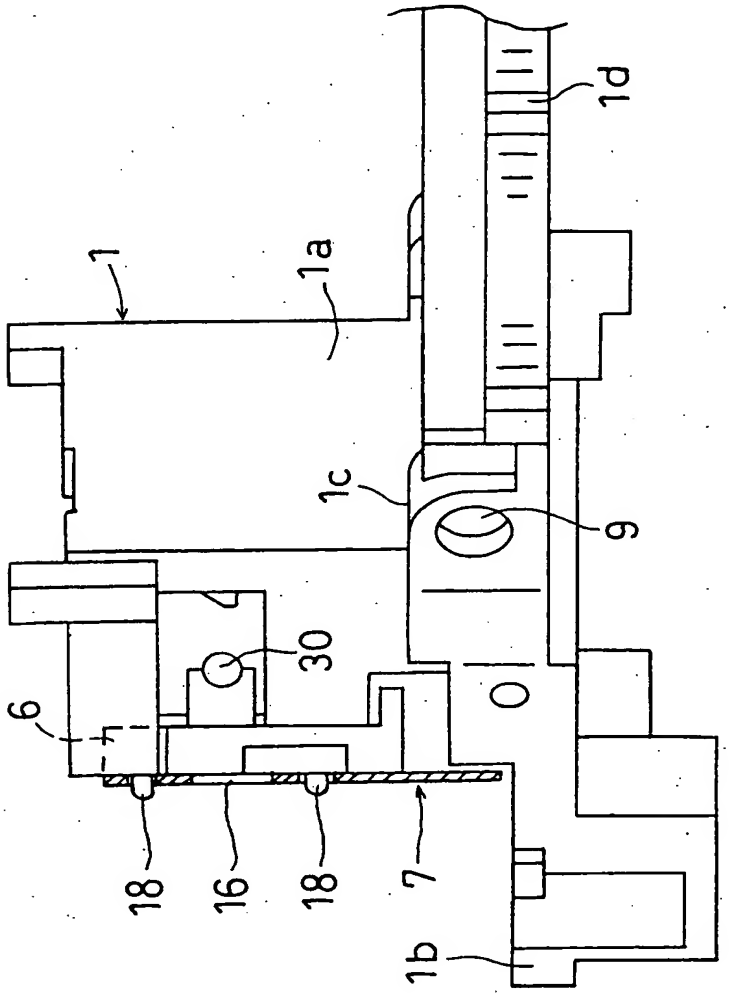
【図４】 Fig.4



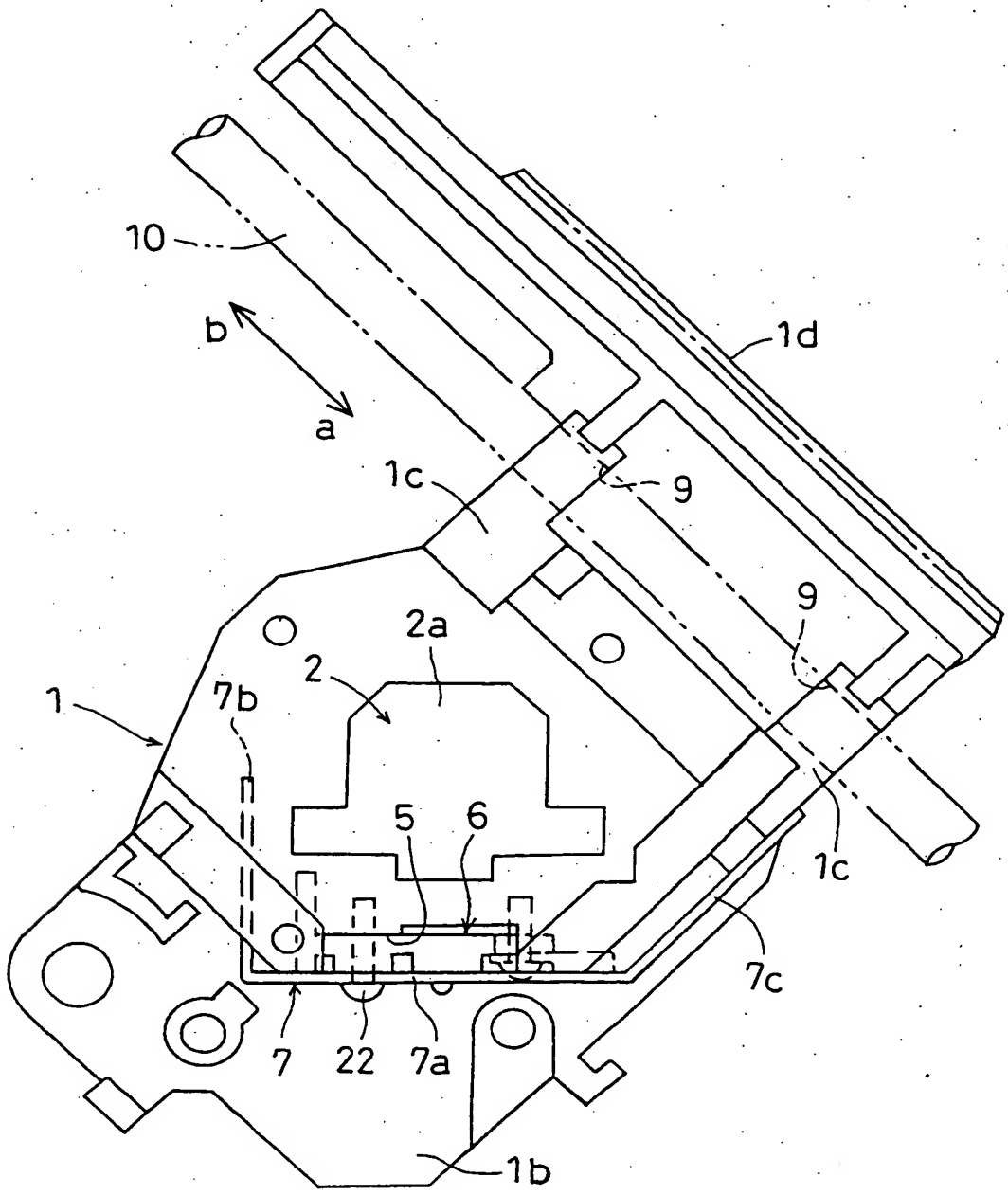
【図５】　Fig. 5


D
1d
1c
9
C
L2
O3
19
7B
22
O1
20
18
A
B
19
20
22
7A
O2
K
L1
LD
16
7a
1b
7
1a
1
D
A
B
C

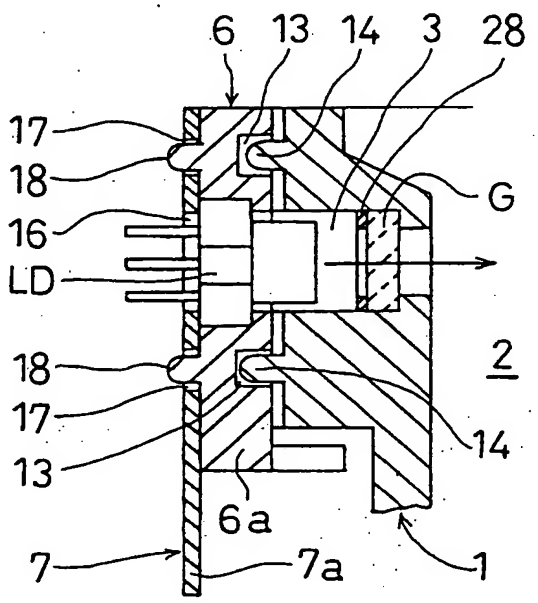
【図６】　Fig. 6



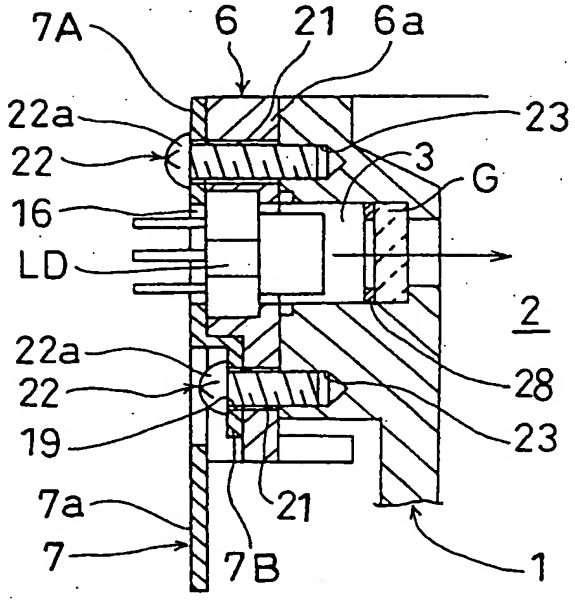
【図７】 Fig. 7



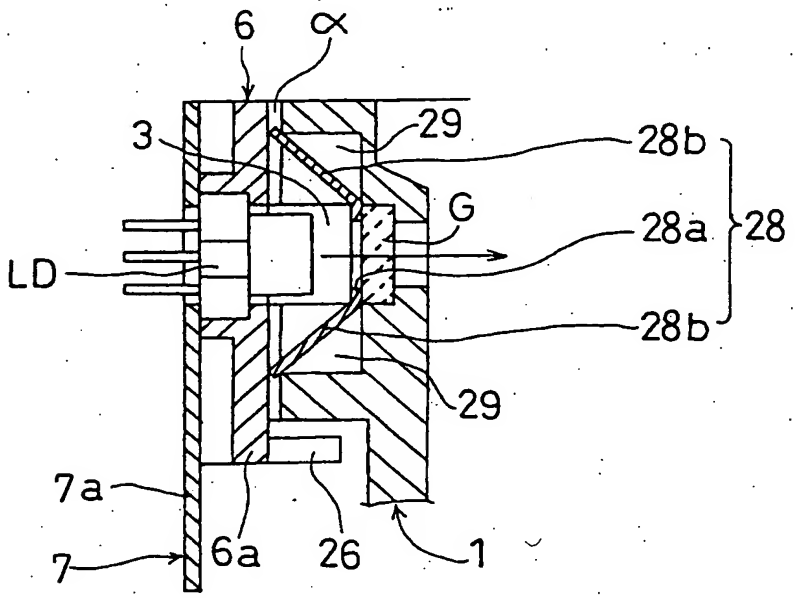
【図８】 Fig. 8



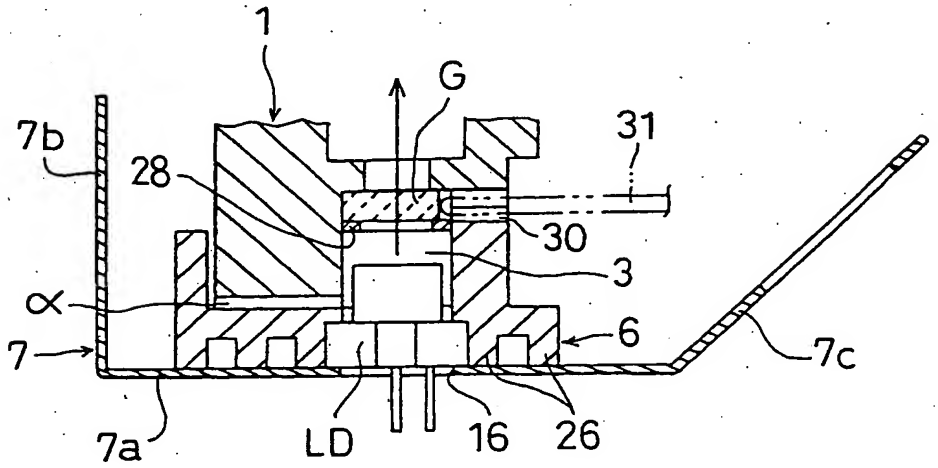
【図９】 Fig. 9



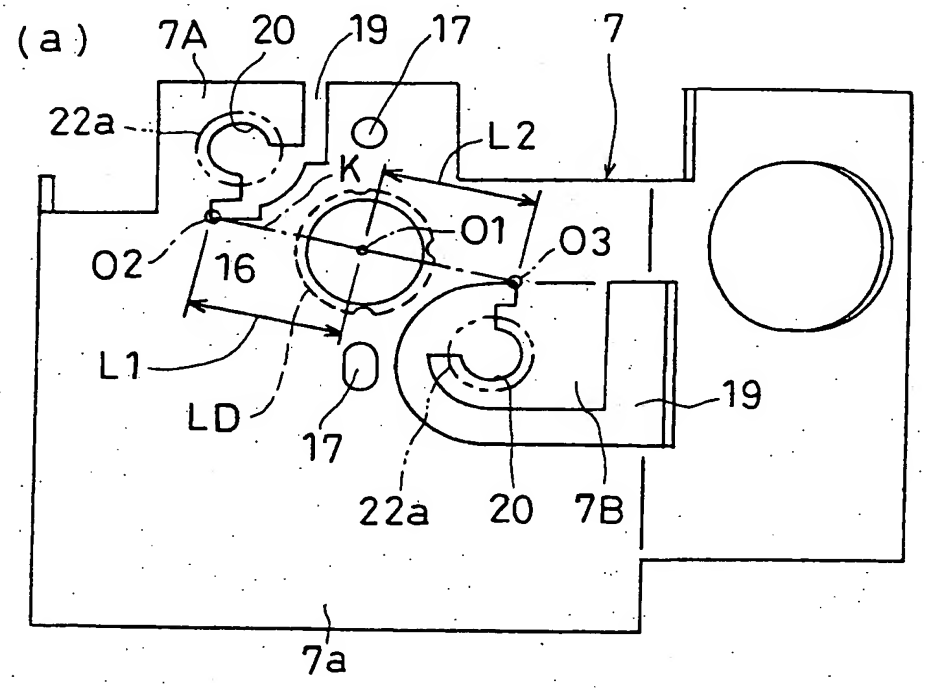
【図１０】 Fig. 10

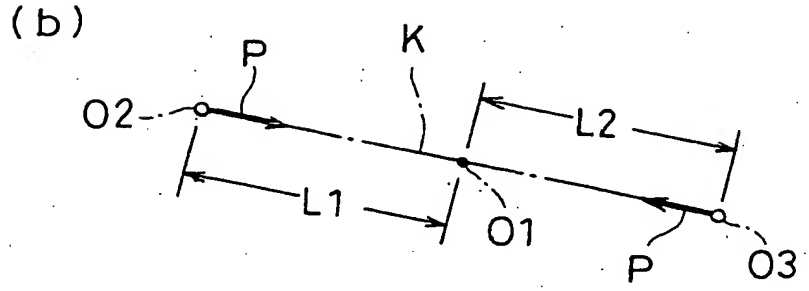


【図１１】 Fig. 11

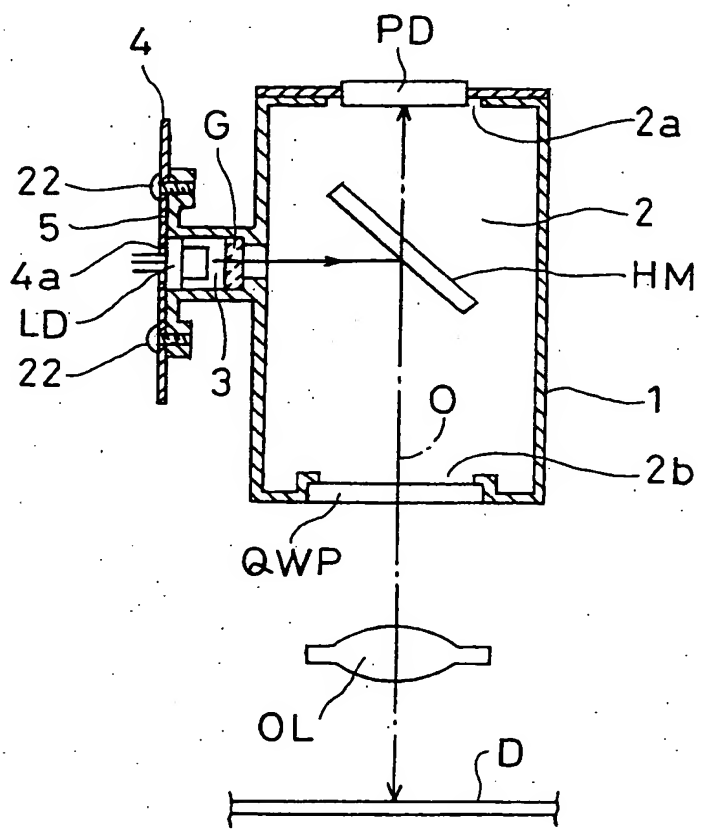


【図１２】 Fig. 12

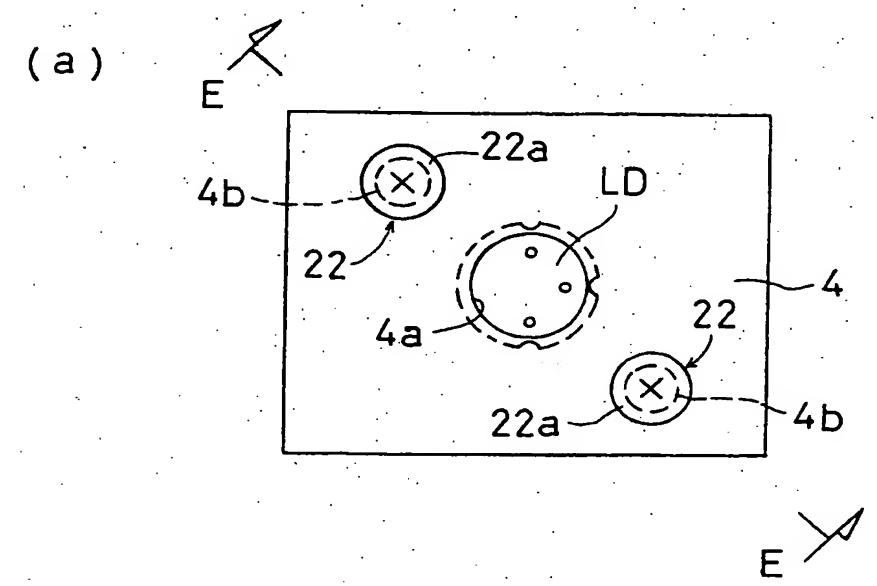

(a)
7A
20
19
17
7
22a
K
L2
O2
16
O1
O3
L1
LD
17
19
22a
20
7B
7a

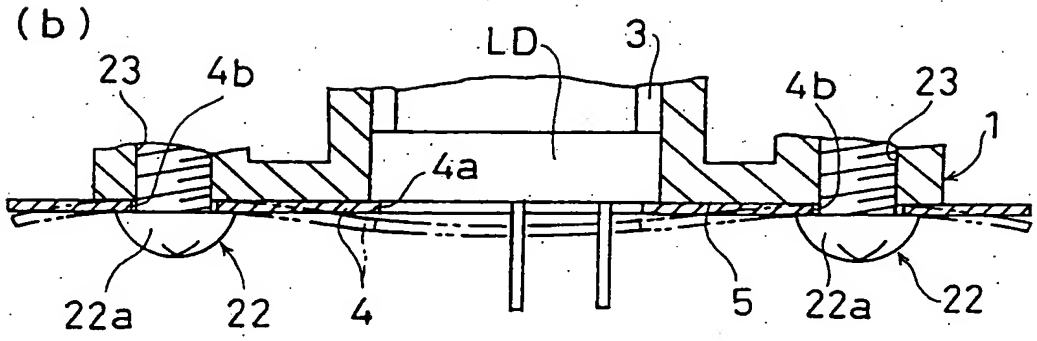

(b)
P
K
O2
L2
L1
O1
P
O3

【図１３】 Fig. 13



【図１４】　Fig. 14





【図１５】　Fig. 15